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AN ANAEROBIC ORGANISM ASSOCIATED WITH ACUTE RHINITIS.*

RUTH TUNNICLIFF.
(From the Memorial Institute for Infectious Diseases, Chicago.)

Many efforts have been made to determine the cause of acute rhinitis and a large variety of organisms have been observed, but so far as I have been able to determine all the investigations have been made with aerobic methods.

The organism now described has been found during the early stages of acute coryza, while the discharge is mucoid in character. At this time few, often no other, bacteria are present in the smears, while this organism is often found in large numbers. As the mucus disappears or the discharge becomes purulent, it decreases in number and finally disappears while other bacteria increase in number. It has been observed in all cases of acute rhinitis studied, 25 different persons having been examined during the acute attack, one during each of four attacks and another during each of five, so that altogether I have made observations during 32 distinct attacks. Many examinations were made during the course of the infection in nine of these cases. In the case of an accompanying pharyngitis, tonsillitis or bronchitis, the organism is also found, sometimes in large numbers in the sputum and mucus of the throat. It was also seen in a case of acute pharyngitis unaccompanied by rhinitis. It was present in small numbers in the nose in five cases examined when the rhinitis was disappearing. It was not found in 20 normal persons, in one case of suspected syphilis and one case of diphtheria. A few were observed in one normal nose. The same organism has been seen in one case of chronic pharyngitis, being practically the only organism present, and in three cases of chronic rhinitis. In some of the lower animals it appears to be present since it was found in the noses of several normal guinea-pigs and rabbits examined, but seen only once in normal dogs. It is not present in the purulent discharge common in rabbits. This same organism was observed in the mucoid discharge from the nose of a dog.

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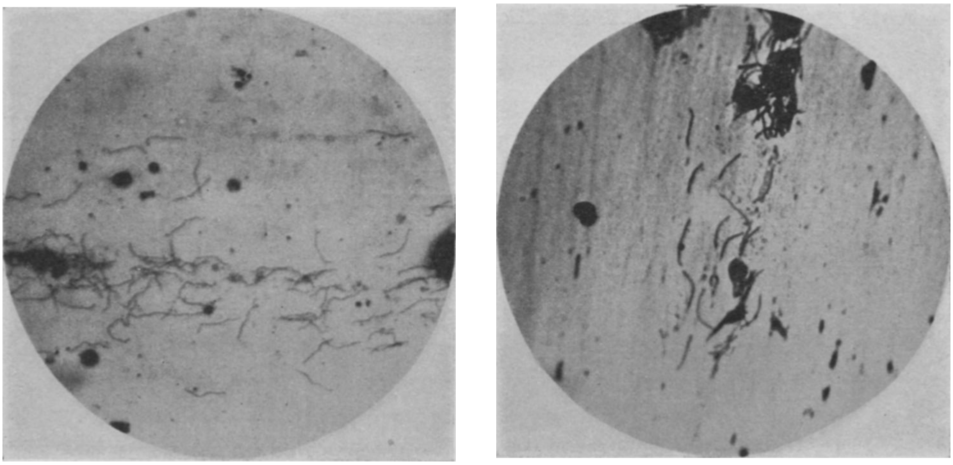
In order to find the organisms a fair amount of mucus should be spread on a slide and often a large number of fields must be examined. They generally appear in clumps, but many are found separate. Carbol-gentian-violet and carbol-fuchsin are the best stains for this organism; but it generally stains rather faintly even with these and it does not stain by Gram's method, methylene blue, carbol-thronin or the Giemsa stain. It may be seen by dark field illumination. Some of the organisms seem to be flexible and move a little, but most of them appear immobile, which may be due to the large amount of mucus present. They vary from five to eight microns in length and from one-third to one-half of a micron in width; the ends are pointed or slightly rounded; generally the bodies are slightly curved, but may be straight, wavy, or bent over at one end. A ring and an enlargement in the form of a ball are occasionally seen at one extremity. Sometimes an arrangement in rosettes and bunches occurs, the organisms radiating from a central mass.



FIGS. 1 and 2.—Smears from nose. Acute rhinitis. ×1000. Carbol-gentian violet.

This organism is a strict anaerobe growing at 37° C. slowly—at least at first. I have isolated it in pure culture eight times, four times from the human nose, three times from the throat and once from the nose of a normal rabbit. Dr. George F. Dick has isolated it once from a case of chronic rhinitis. It has been cultivated several other times but not isolated in pure culture. It was isolated on the surface of goat blood agar in large test tubes, the agar being slightly alkalin to phenolphthalein. The cultures were made anaerobic by the Wright method of saturating the cotton stopper with a strong solution of pyrogallic acid and a five per cent sodium hydroxid solution, closing the tube with a tightly fitting cork and sealing it with paraffin. The colonies appear in from five days to a month, usually in about seven days, as small, round, dull growths. After several transfers growth becomes more active and less dull in appearance and in old cultures it becomes thick and greenish yellow, or brown in color. Growth also occurs in dextrose agar, dextrose and horse serum agar, ascites agar, and ascites agar with rabbit kidney tissue, along the stab canal as a distinct creamy growth, but produces no haziness. On plain agar there is but little growth, sometimes none, and there is no growth in plain broth or in milk and generally none on the surface of Loeffler's blood serum. When it grows in dextrose broth, the growth is flocculent. The various strains agree culturally except in their growth on potato, two producing a yellow growth, one a cream colored growth in the fluid only, the one from the rabbit, white colonies, and the others no growth at all. Evidently the age of the culture and the number of organisms inoculated are important in determining growth, the same strains varying, sometimes growing in a given medium, sometimes not.

Examined by dark field illumination the organism from cultures is flexible and motile, but loses motion quickly. It is progressive, tumbling, and vibratory. Attached to the ends and sides and also free are light refractile bodies, the free ones being actively motile.

In cultures the organisms measure from three to eight microns in length and one-third to one-half of a micron in width. The organism now stains a little more deeply than in the smears from the mucus, but remains gram-negative. It varies in its ability to stain with methylene blue, some cultures not staining when first isolated tho staining later, other strains staining when first isolated. Organisms grown in dextrose agar and in the fluid of condensation of Loeffler's blood serum show deeply staining bands.

Morphologically the organisms from cultures look like the organisms found in the smears from the mucus, but after long cultivation there is a tendency in some strains to become larger, straighter and less bunched, while in early culture they are delicate, straight, slightly curved, some very wavy and some showing a radiating arrangement. Darkly staining bodies are seen attached to the ends and sides and also free; and an organism with a ring at one end is occasionally observed. Forms which are especially curved are seen in old cultures. Flagella have not yet been demonstrated. The organism looks a good deal like a spirochete, but culturally it seems more like a bacillus and whether it is a spirochete or a bacillus must be decided later.

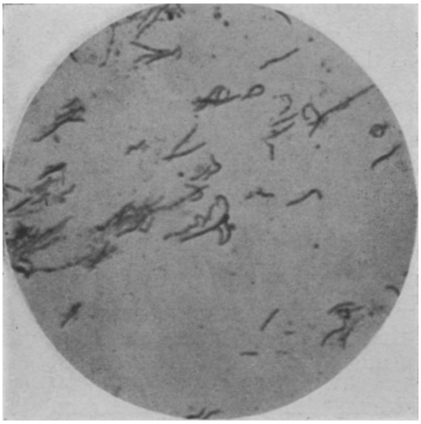


FIG. 3.—Pure culture, one month old. ×1200. Carbol-gentian-violet.

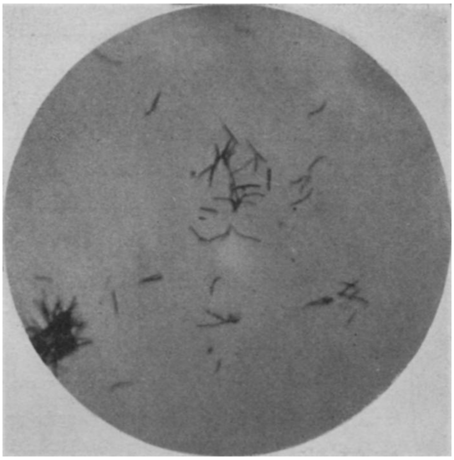


FIG. 4.—Pure culture, five days old. ×1000. Carbol-gentian-violet.

These organisms in the mucus may be distinguished from cilia, by staining with a watery solution of eosin, the organisms not staining, and by the growth of the organism in cultures. They differ from fusiform bacilli, in not staining so distinctly, in being more delicate and not fusiform in shape, and in their motility. Culturally after they have been grown through several generations and have lost their dull appearance, their growth is much like that of fusiform bacilli. Morphologically and in their staining reactions they resemble the "nadel-förmigen bakterien" of Shmamine,[1] associated with *Spirochaeta pallida*, but they differ from them in not forming the spirochete looking forms until grown several weeks, in being motile and in their growth, the "nadel-förmigen bakterien" producing a growth identical with that of the *Spirochaeta pallida*.

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[1] *Centralbl. f. Bakteriol., I Orig.*, 1912, 65, p. 311.

During the acute stage of rhinitis the opsonic index to this organism is low, rising as the infection subsides.

A slight rhinitis has been produced several times in human subjects (twice in myself, once in a laboratory assistant) by swabbing a nose which was free from this organism, with a pure culture. A pharyngitis accompanied the rhinitis twice. The infection began from six to eight hours after the inoculation and lasted about 48 hours. The organisms were present in fairly large numbers in the nose and pharynx (in the cases with pharyngitis) 18 hours after the inoculation and persisted for three days in two of the cases. Cultures were made twice and the organisms isolated in pure culture both times. The opsonic index was taken during two of these infections. Both times it fell below normal, rising high above normal as the infection disappeared.

A slight rhinitis has been produced in a dog also, the organisms disappearing from the nose in 24 hours. The organisms were grown through several generations, but not isolated in pure culture.

Two patients have been injected with the killed organisms to determine the number of organisms and the frequency of injections necessary to produce a definite reaction and not with any idea of drawing conclusions as to the value of the vaccine. The vaccine was made in the usual way, heating the suspension at 60° C. for one hour. The organism had been isolated from a patient with acute rhinitis. This patient had recurring attacks of acute coryza and pharyngitis, the organisms being found in the nose and pharynx only during the infections. Three injections were given, one week elapsing between each; 50,000 only were injected the first time, 100,000 the second and 200,000 the third. After each injection the negative phase of the opsonic index has been less and the rise higher, being 1.5, 2.5 and 3.5 respectively. After each injection there was a slight rhinitis and pharyngitis, but no severe infections have occurred.

The other patient had a severe persistent rhinitis with a profuse mucoid discharge and severe attacks of sneezing. He had had an operation on the nose and had used various sprays without receiving any relief. These organisms were present in enormous numbers in the discharge from the nose and were the predominating organisms. Before the injections his opsonic index was 0.6. He received at the first injection 50,000 killed organisms and the number was increased each time, about four days elapsing between each injection. After the first, the index rose to 2.1 within 24 hours and remained high for four days, the discharge and sneezing almost disappearing. The second injection (200,000) was given when the index had fallen to 0.4 and after this injection the index did not rise above normal and the patient felt less well and had more discharge. After the third injection (165,000), four days after the second, he was much better in every way, having practically no discharge and no sneezing attacks, the index reaching 1.9. Five days after the fourth injection (250,000) he had several severe attacks of sneezing and a large amount of discharge which stopped after the fifth injection (350,000), the patient's general condition also being much improved. It is too soon to know whether the improvement will be permanent and how long the treatment must be continued, but the small doses were evidently sufficient to produce definite changes in the blood and symptoms.

Whether this anaerobe is the cause of acute rhinitis must be determined by further investigation. My observations show that in the cases of acute rhinitis examined, it was present constantly during the early stage of the coryza and disappeared as the infection subsided.